

# MONTHLY WEATHER REVIEW,

## JANUARY, 1879.

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WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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### INTRODUCTION.

In compiling the present REVIEW the following data, received up to February 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 119 Signal Service stations and 11 Canadian stations, as telegraphed to this office; monthly journals and means, 121 and 144 respectively, from the former, and monthly means from 12 of the latter; reports from 21 special Sunset stations; 243 monthly registers from Voluntary Observers; 52 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers and the local Weather Services of the States of Iowa and Missouri; reliable newspaper extracts; special reports.

### BAROMETRIC PRESSURE.

Upon chart No. II is exhibited by the isobaric lines the general distribution of the atmospheric pressure, as reduced to sea-level, for the month. Compared with the means for January of previous years, the pressure is above the normal on the Pacific coast and from Wyoming and New Mexico to the Lower Ohio valley, and thence to the Gulf of Mexico and southern portion of the South Atlantic States. Over Lake Superior and from the Lower Lakes to North Carolina and thence northeastward it has been below the normal, especially over New England, the deficiency gradually increasing to Maine, where, at Portland, the mean pressure is 0.16 inch below the normal.

*The Local Barometric Ranges* for the month, as reduced to sea-level, have been largest over New England, and from Dakota and Minnesota to Kansas. Taken by districts they vary as follows:—New England, from 1.83 at Eastport, to 1.19 at New Haven; summit of Mt. Washington, 1.26; Middle Atlantic States, 1.25 at Philadelphia to 1.02 at Lynchburg; South Atlantic States, 1.00 at Charlotte to 0.64 at Jacksonville; Lake region, 0.87 at Chicago to 1.16 at Oswego and 1.35 at Duluth; Ohio valley and Tennessee, 1.09 at Morgantown, and 1.13 at Knoxville to 0.76 at Nashville; Gulf States, 0.37 at Key West to 1.00 at Corsicana and 1.14 Brackettsville; the Northwest and Eastern slope of the Rocky mountains, 0.98 at St. Louis to 1.10 at Fort Sill, 1.48 at North Platte, 1.57 at Yankton and 1.71 at Pembina; Rocky mountain stations, 0.71 at Santa Fe to 0.83 at Denver; summit of Pikes Peak, 0.63; Western Plateau, 0.81 at Pioche to 1.01 at Boise City; Pacific coast, 0.41 at Campo, and 0.52 at San Diego to 1.13 at Portland, Or.

*Areas of High Barometer.*—Eleven are described below. Four of them, namely: Nos. I, II, V and VI, deserve special notice as they produced the minimum temperatures of the month over the regions traversed by them.

No. I.—This area, which was over the northwest territory of British America during the 1st and 2d of January, moved slowly south and east over the United States from the 3d to the 7th, and over the Bermudas on the 8th. A telegraphic dispatch received at St. Paul, Minn., January 3d, reported the following low temperatures in British America: —60° at Battlefield, the capital of the Northwest Territory; —35° at Ft. Pelly, and —29° at Winnipeg. The lowest temperatures recorded over the United States, (Signal Service observations,) were: over the Northwest, —32° at Pembina on the 1st and at Breckenridge on the 2d; in the Mississippi valley, —26.02 at St. Paul and La Crosse on the 2d, to 20° at New Orleans on the 6th; in the Atlantic States, —5° at Fort Whipple, Va., on the 3d, to 25° at Jacksonville, Fla., on the 7th; and at Prospect, Bermudas, 45.05 on the 8th. On the 1st the pressure rose west of the Mississippi, and on the morning of this day the isotherm of zero curved through Wisconsin, Nebraska, Colorado and Idaho. 2d, th pressure continued highest over the Northwest, and rising thence to the Gulf, South and Middle Atlantic

coasts and Lower Lake region; the morning isotherm of zero curved through Michigan, Indiana, Missouri, Colorado, Wyoming and western Montana. 3d, the highest pressure extended from Minnesota to Missouri, and the morning isotherm of zero curved through Michigan, New York, Connecticut, Virginia, Tennessee, Indian Territory, Colorado and Montana; the lowest temperature ( $-29^{\circ}$ ) was reported at Bismarck. 4th, the region of highest pressure remained almost stationary and the temperature generally rose slightly. The morning isotherm of zero curved south over Lake Michigan, thence east to Pennsylvania and westward through Tennessee, Arkansas, Colorado and western Dakota. The lowest temperature ( $-30^{\circ}$ ) occurred at Yankton. 5th, the region of highest pressure continued almost stationary until evening, when the pressure fell rapidly over the Northwest and the maximum was transferred to the Southwest. The lowest morning temperature ( $-29^{\circ}$ ) occurred at Bismarck, but a rapid rise occurred over this region during the day; the morning isotherm of zero curved through Wisconsin, thence to Pennsylvania and westward through Kentucky, Missouri, Kansas, Nebraska and western Dakota. 6th, the highest pressures extended from the Ohio valley to the Gulf of Mexico, over which region the morning minimum temperatures ranged from  $2^{\circ}$  at Knoxville to  $22^{\circ}$  at St. Marks; the temperature still remaining below zero from Indiana and Indian Territory to Minnesota. 7th, the highest pressure moved over the South and Middle Atlantic States, the minimum morning temperatures ranging from  $12^{\circ}$  at Washington and Charlotte to  $27^{\circ}$  at Savannah; the temperature was everywhere above zero. 8th, highest pressure probably passed eastward, over or near the Bermudas, where the minimum morning temperature was  $45.05$ . High northeast to northwest winds preceded this area, and Cautionary Off-shore Signals were ordered up along the Gulf coast at midnight of the 1st and morning of the 2d, and were justified by the following velocities: Indianola, NE. 36, Galveston, N. 25, and St. Marks, NW. 28. Along the Atlantic coast the Signals hoisted on the 1st for storm No. II were changed to Cautionary Off-shore on the 2d, and the velocities are noticed under that storm, as also, the high winds and severe snow-storms in the Lake region. The continued northwesterly winds along the Atlantic coast produced very low tides, and the observer at Baltimore reported the lowest tide on record at that place, on the 4th and 5th, during which several steamships and other vessels grounded in the channel. As some of the results of the extreme cold, the following items may be of interest: deaths from freezing were reported at Wilksbarre, Pa., Fort Wayne and Vincennes, Ind., Leavenworth, Kan., Chicago, Ill., near Rockport, Copiah Co., and in Lincoln Co., Miss.; all the locomotives on the Dakota Southern and New York city elevated railroads were disabled by freezing; river navigation was suspended at Cairo, where the ice in the Ohio extended from shore to shore, and at Memphis it was seriously interfered with by heavy floating ice filling the river from bank to bank and by the landings being ice-bound.

No. II.—The pressure gradually increased over Washington Territory and Oregon, from the 1st to the 7th, and clear or fair weather, with cool northerly winds prevailed on the Pacific coast during these days, excepting the rains of the 1st and 2d, attending low area No. I. On the 7th the pressure reached the maximum at Portland, Or., and high northerly winds prevailed over California and Nevada. At Mare Island, Cal., high northwest winds continued from 9 a. m. to 4 p. m., with an average velocity of 39 miles per hour. The following velocities were also recorded at Signal Service stations: San Francisco, NE. 40; San Diego, N. 28; Sacramento, N. 33; Winnemucca, (on the 6th,) NW. 40; Pioche, N. 32. 8th, highest pressures over California, with light winds and calms, and clear, cool weather.

No. III.—During the 8th the pressure rose over the Eastern slope, and northerly winds, with sleet and snow prevailed over the Southwest. 9th, this area extended from the Gulf to the Lakes, and on the 10th moved off the Atlantic coast, with increasing pressure. 11th and 12th, it passed eastward over the Bermudas.

No. IV.—This area moved in rear of low area No. V. It appeared on the Pacific coast on the 10th and probably extended from Arizona to Texas on the 11th. On the 12th and 13th it was over the Gulf States, with diminishing pressure. Cautionary Off-shore Signals were ordered along the Gulf coast on the 11th and the following maximum velocities recorded on the 12th: Indianola, N. 31, Galveston, W. 36, and St. Marks, NW. 28.

No. V—was over Manitoba on the 14th, and on the 15th moved eastward north of the Lake region to New England. The minimum temperatures on the morning of the 15th, at Saugeen and Rockliffe, were  $-26^{\circ}$  and  $-27^{\circ}$ , respectively. On the morning of the 16th it was over Maine and lower Canada, while low area No. VIII was over the Lower Lakes.

No. VI—appeared over Oregon and Washington Territory on the 14th, and remained on the Pacific coast until the 18th, accompanied by generally clear and cool weather. On the morning of the 16th the following minimum temperatures of the month were recorded:—Los Angeles,  $36^{\circ}$ ; San Diego,  $35^{\circ}$ ; Red Bluff,  $27^{\circ}$ ; and Sacramento,  $29^{\circ}$ . 18th, this area extended eastward over the Western plateau, Rocky Mountain region and Eastern slope, and during the day the minimum temperature of the month ( $-33^{\circ}$ ) was recorded at the summit of Pikes Peak. 19th, it extended from the Rocky mountains to the Southwest. 20th, covered the Gulf of Mexico and on the 21st passed eastward over Florida.

No. VII—developed during the 16th over the Eastern slope, in rear of low area No. VIII and by 11 p. m. had moved into the Ohio valley. 17th, passed over the Middle Atlantic States and New England.

No. VIII—developed over the Eastern slope on the 22nd, in rear of low pressure area No. XII. 23rd, moved into the Ohio valley and on the morning of the 24th covered the Atlantic States.

No. IX—appeared over the Northwest, in rear of low area No. XIII, on the morning of the 25th and moved eastward during the day to the Lake region. 26th and 27th passed southeast off the Atlantic coast.

No. X—developed over the Upper Mississippi valley and Lake region on the 28th, in rear of low area No. XIV. It was probably dissipated on the 30th while over the Lower Lake region.

No. XI—appeared over the Northwest on the 29th where it remained central until the 31st.

*Areas of Low Barometer.*—Fifteen are described and the tracks of eleven centres are shown on chart No. I. Five had their origin west of the Rocky mountains, three of which (Nos. IV, V and VIII) followed very similar paths, namely, southeastward over the Western Plateau to the Southwest, and thence northeastward over the eastern section of the United States, during the first half of the month; the other two (Nos. XIII and XIV) passed eastward along the northern boundary, and were instrumental in producing the southerly winds and high temperatures of the latter half of the month. From the small table at the lower left-hand corner of the chart it will be seen that the storm-centres of the present month have moved with unusual rapidity across the country, and a study of the International Charts shows that some, at least, continued to move rapidly eastward after leaving the Atlantic sea-board. This is in strong contrast to the storm-centres of November and first half of December, during which period the average velocity of storm-centres across the land was much slower.

No. I—is an area of low pressure which existed during the last few days of December, and continued during the 1st of January, central off the California coast. It produced heavy rains along the coast from Santa Barbara to Los Angeles on the 31st, and a waterspout, which was first observed on the ocean, passed northeastward up the valley of Mission creek, during considerable damage. The observer at Santa Barbara reports 1st, 12:15 a. m. to 3:45 p. m., heavy east wind, one man killed by falling chimney. Considerable damage to wharf, wind-mills, fences, shade trees and houses. At Mare Island, Cal., an easterly gale prevailed from 5 a. m. to 9 p. m. of January 1st, with an average force of 44 miles per hour. The track of this centre is not charted.

No. II.—On December 31st, as an area of high pressure was moving eastward off the Atlantic coast, a centre of low pressure apparently developed over the Gulf of Mexico, which moved, *January 1st*, northeastward to North Carolina, accompanied by light rains and winds. On the 1st the pressure also fell in the Lake Region, and by night a depression was central north of Lake Huron, with increasing westerly winds and snow over Lake Michigan and Illinois, in advance of high pressure area No. I, the weather accompanying which latter area was to prove the most notable meteorological feature of the month. 2nd, the centre moved rapidly eastward to New England, and, joining the one from the Gulf, quickly developed into a severe storm; at 11 p. m. the pressure was lowest at Eastport, where the barometer read 28.82, or 1.18 in. below normal. At this station and at Quebec a severe easterly gale, with snow, prevailed; on the summit of Mt. Washington the wind was NW. 84 miles, heavy snow; and thence over the Lake region and Middle States a steep barometric gradient existed, with brisk to high westerly winds and rapidly falling temperature. 3rd, the centre moved very slowly eastward over eastern Maine, the pressure at Eastport remaining throughout the day about 28.55, or about 1.45 in. below normal; the lowest reading, 28.49, or 1.51 below, occurred at 2 p. m., January 3rd, after which time the wind changed from S. to NW. Light winds prevailed in the Canadian Maritime Provinces, but over New England, the Middle States and Lower Lake region very cold and high westerly winds and gales attended the steep barometric gradient. 4th, the centre passed eastward over Nova Scotia, the lowest pressure (apparently about 28.50, or 1.50 in. below normal occurring at Halifax before the 7:35 a. m. observation, at which time the wind had changed to N. Light winds and calms prevailed over the Canadian Maritime Provinces and brisk westerly winds over New England. The barometric gradient over the Lower Lake region and Middle States continued very steep during the daytime, with high westerly winds and gales, but diminished after sunset with decreasing winds. Snow continued on the 5th in the Lower Lake region, but with diminished winds and higher temperatures. Although the measured quantities of snow were quite moderate, except at Rochester on the 3d and 4th, when 2.31 inches, melted snow, were recorded, it was so badly drifted by the attending high winds as to seriously impede railroad communication, and traffic on the lines along the lake shores east of Cleveland was almost entirely suspended for several days. Cautionary Signals were ordered at midnight of the 1st from Cape Lookout to Sandy Hook, which were changed to Cautionary Off-shore on the 2d, and at Milwaukee, Grand Haven and Ludington; and on the morning of the 2d along the New England coast, which were changed to Off-shore during the afternoon. These Signals were all justified, and the following (measured) high wind velocities were recorded: On the 2d, Milwaukee, W., 41; Oswego, W., 40; Morgantown, W., 42; Grand Haven, NW., 41; Eastport, E., 60; Boston, W., 40; Wood's Holl, NW, 62; Sandy Hook, W., 72. 3rd, Buffalo, SW., 47; Newport, W., 48; Barnegat, W., 48. 4th, Cape Lookout, NW., 44; Cape May, W. and NW., 60; Philadelphia, W. 48. For the progress of this storm over the Atlantic ocean attention is called to the chapter on International Meteorology.

No. III.—As high pressure area No. I. moved southward along the eastern slope of the Rocky Mountains on the 6th the pressure fell rapidly from Manitoba to Utah, with snow during latter part of day. At 4:35 p. m., the barometer at Pembina had fallen to 29.59 or 0.53 in. below normal, after which it commenced rising, and a secondary depression (low area No. IV.) formed over Utah. 7th, centre moved eastward north of the Upper Lakes, with southerly to westerly winds and light snows thence to the Ohio valley. 8th, moved eastward over Quebec, and southwesterly winds, cloudy and rainy or snowy weather prevailed, thence to Michigan, the Ohio valley, Middle States, New England, Nova Scotia and Cape Breton. 9th, it probably passed northeast over Labrador, but as its entire path was to the north of our stations it is not

charted. Cautionary Signals were ordered up at midnight of the 6th at Milwaukee, Grand Haven and Ludington, which were justified, although late at Milwaukee.

No. IV—developed over the western Plateau in the southwest quadrant of preceding area, during the latter part of the 6th. 7th., at 7.35 a. m. and 4.35 p. m. it was central over New Mexico, the barometer at Santa Fe reading about 29.47 or 0.26 below normal; southerly winds, cloud and rain prevailed over southern portion of Arizona and from Texas to the Lower Mississippi valley, and brisk to high northerly winds and snow from Nebraska to Utah and northern portions of Arizona and New Mexico; at Fillmore, Utah, seven inches of snow fell on the 6th and 7th. At 11 p. m., the centre was transferred to the Lower Rio Grande valley, and northerly winds and snow extended to southern portions of Arizona and New Mexico. 8th, moved northeast over the Gulf States, followed by northerly winds, increasing to gales along the coast, snow, sleet and rain in the Southwest, and accompanied over the interior of the Gulf States and Tennessee by heavy rains. 9th, moved rapidly northeast and at 11 p. m., was central between Capes Cod and Sable; east to south winds and heavy rains prevailed from eastern Tennessee to New Jersey, and northerly winds, with heavy snows from West Virginia to New England, thus creating a second snow blockade, or rather prolonging that which attended area No. II; at 11 p. m., high northwest winds and gales prevailed along the coast from North Carolina to Maine. 10th, the centre moved rapidly northeastward and its further history will be noted under International Meteorology. Cautionary Signals were ordered at Indianola and Galveston at midnight of the 6th, changed to Off-Shore midnight of the 7th; at Mobile and St. Marks at midnight of the 8th, changed to Off-Shore, morning of the 9th; from Savannah to Macon, morning of the 9th, from Cape Lookout to Wood's Holl, morning of the 8th and from Boston to Eastport, afternoon of the 9th; those along the Atlantic coast were changed to Off-Shore, on the afternoon of the 9th. All signals were justified. The following maximum velocities were recorded:—on the 8th, at Indianola, N., 54; Galveston, NW., 40; on the 9th, Wilmington and Capes Lookout and Hatteras, SW., 44; Cape May, NW., 56; New York, NW., 40; on the 10th, Sandy Hook, NW., 56; Wood's Holl, NW., 48; Mt. Washington, NW., 81.

No. V.—During the 8th the pressure fell rapidly from Washington Territory and Oregon to western Montana, with rain and snow gradually extending southward; over five inches of snow fell at New Westminster, Brit. Col., and at Yreka, Cal. 9th, the depression moved southward over the Western plateau, and by 11 p. m., was over Utah. Rain or snow, followed by clear or fair weather, prevailed from Idaho to northern California; from four to five inches of snow was reported at three stations in Nevada, and southerly winds, with rising temperature, over the Eastern slope. 10th, moved slowly southeast and by 11 p. m., was over northwestern Texas; rapidly falling temperature with snow, prevailed in eastern Arizona and southern New Mexico and south to east winds, increasing cloudiness, and, by night, a general light rain from Indian Territory to the West Gulf coast. 11th, at 7.35 a. m., the lowest pressure was over southern Texas; rain prevailed from Texas to Mississippi and heavy snow from Indian Territory to Cairo. During the day, it moved northeast to Alabama, with heavy rains in its northern quadrant from Louisiana to Tennessee. 12th, moved eastward off the North Carolina coast, where a severe gale prevailed at night, and was accompanied by heavy rains from Georgia and east Tennessee to Virginia. These rains, together with those of the 8th and 9th, accompanying area No. IV, resulted in heavy freshets in the rivers of this section; much damage occurred on those rivers which were ice-gorged, especially those of eastern Tennessee. 13th, the depression passed north of Bermuda, as shown on chart No. I, after which it has not been traced. Cautionary Signals were ordered on the 11th from Charleston to Sandy Hook, which were all justified; and on the morning of the 12th, from New York to Wood's Holl, which latter were only justified within 100 miles of Sandy Hook. Maximum velocities on the 12th: Charleston, SW., 30; Wilmington, SW., 32; Cape Lookout, NW., 40; Kittyhawk, N., 63; Cape Henry, NE., 52; along the New Jersey coast, the highest winds were NE., brisk.

No. VI passed eastward on the 9th north of Minnesota, where southerly winds and light snow prevailed.

No. VII.—As high pressure area No. IV moved southward on the 10th over California, in rear of low area No. V, the barometer fell to the northward with increasing precipitation and fresh to brisk southerly winds, and at 11 p. m., the lowest pressure was probably central on the coast of Washington Territory; at 4 p. m., a heavy SE gale prevailed over the Gulf of Georgia, while northeasterly winds were reported at Victoria, V. I., and New Westminster and Lytton, British Columbia. 11th, the lowest pressure extended from Oregon to Montana, and rain or snow fell from northern California, where it was heaviest, to Idaho and northward. During the preceding night a southeast gale prevailed in the Sacramento valley—maximum velocity at Red Bluff, SE., 44 miles. 12th.—Higher pressures from Oregon to western Montana. At 7.35 a. m., the lowest pressure was recorded at Bismarck, Dak., (29.77 or 0.33 in below normal), where calm, clear weather prevailed; at 11 p. m., the lowest pressures were recorded at Duluth and Marquette (29.78 or 0.30 below normal). East to north winds and snow prevailed throughout the day in Manitoba, and southerly winds with fair weather in Minnesota. 13th, was north of the Lake region and St. Lawrence valley; heavy snow and brisk to high winds were reported in latter section. Cautionary Signals were ordered up at Milwaukee, Grand Haven and Ludington, on the morning of the 13th in anticipation of increasing westerly winds, but were not justified, possibly because of the advance of area No. VIII.

No. VIII—crossed the United States and probably the Atlantic Ocean. It appeared during the 13th to the north of Washington Territory and Idaho; southerly winds prevailed, with rain on the Pacific coast and snow in Idaho; by night the winds changed to northwest on the coast of Oregon, when the lowest pres-

sure was probably over Idaho. 14th, it moved rapidly southward to Arizona as a heavy storm; heavy snows and brisk southerly, changing to northerly, winds prevailed over the *Western Plateaus*, and rain or snow followed by clear weather in northern California; at St. George, in southern Utah, a smart shower was reported after 9 p. m., and heavy rain fell in southern New Mexico during latter part of day. 15th, moved rapidly northeast to Illinois, preceded by easterly winds, increasing cloudiness and, by evening, rain or snow from Tennessee to the Lake Region and Middle Atlantic States. Heavy snow fell from Kansas to Lake Michigan. 16th, it moved rapidly eastward and by 4:35 p. m. the centre was off Long Island. North of the centre, namely, from the Lower Lakes to New England, cold northerly winds and heavy snow prevailed, but at the immediate centre, and thence southward, high temperatures, southerly winds and rain. The following temperatures were recorded at 7:35 a. m.: at Louisville and Cincinnati, 41°; Pittsburg, 42°; Erie, 38°; Buffalo, 16°; Rochester, 12° and Albany —1°. At 11 p. m., northwest winds and clear, cool weather prevailed throughout the Atlantic States, in advance of high area No. VII. Cautionary Signals were ordered up on the morning of the 15th at Milwaukee, Grand Haven, Ludington and along the Atlantic coast from North Carolina to New Jersey; at 11 p. m. from New York to Wood's Holl, and, on the morning of the 16th, thence to Eastport. They were justified, except at Cape Henry, Norfolk, Portland and Eastport. The maximum velocities were: Milwaukee, E., 36; Cape Lookout, N.E., 36; Cape May, N., 28; Sandy Hook, E., 36; and Wood's Holl, N.W., 32.

No. IX—was central north of the Lake region on the 17th. A barometric depression extended thence to the Gulf, over which region snow or rain prevailed. The precipitation was heaviest from central Texas to Missouri and Tennessee, and the map of departures from the normal show the formation of a new centre of depression, which will be described as area No. X. 18th, the present centre of depression moved eastward to the Gulf of St. Lawrence, and southerly winds, with snow or rain, prevailed over the Atlantic States. At 11 p. m., the wind had veered to northwest, with clear weather over the Middle States and New England. No signals were ordered for this disturbance.

No. X.—As stated above, this centre probably formed in the southern extremity of the former depression. During the 18th, it was over the South Atlantic States, where cloudy and rainy weather prevailed. 19th, it moved northeast off the coast with increasing energy. 20th, passed eastward south of Nova Scotia and Cape Breton; the pressure at Sydney falling to 29.00, or about 0.96 in. below normal. Cautionary Off-shore Signals were ordered up on the morning of the 19th from Smithville, N. C., to Sandy Hook, which were justified on the 20th by the following maximum velocities: Wilmington, N.W., 33; Cape Lookout, N.W., 41; Kittyhawk, N., 50; Cape Henry and Cape May, N.W., 56; and Sandy Hook, N.W., 34. As the centre passed south of Nova Scotia it was attended by brisk to high northeast, backing to northwest, winds; and hard gales were reported in 41° N., 58° W.

No. XI—was central on the 21st north of the Lakes, in which region light snow prevailed, extending by night to New England. 22nd, passed east over Maine and Nova Scotia, with heavy snow and fresh to brisk winds. Cautionary Signals were ordered from North Carolina to Maine, and the following maximum velocities recorded: Kittyhawk, S. 26; Cape Henry, S.E. 28; Cape May, S. 36; and Wood's Holl, S.W. 36.

No. XII—was central over Iowa on the morning of the 22d, having developed in the southwest quadrant of the preceding area. During the day it moved eastward accompanied by cloudy or fair weather, and by rising temperature south of the centre; at 11 p. m. it was central over Lake Erie and light rain or snow prevailed thence to Vermont and Ontario. 23d, passed over New England and Nova Scotia with sleet or snow over the Canadian Provinces and Maine, but followed by clear weather by night. Cautionary Signals were ordered up on the afternoon of the 22d on the North Carolina and New Jersey coasts, and those ordered up along the New England coast in advance of the preceding area were continued. The following maximum velocities were recorded: Cape Hatteras, S.W., 27; Cape May, S.W., 28; Sandy Hook N.W., 36, and Eastport, N.W., 29.

No. XIII.—This area appeared over Oregon and Washington Territory during the latter part of the 22nd, and passing eastward along the northern boundary of the United States, during the 23rd, 24th and 25th, produced southerly winds and high temperatures over the entire country during these days. Heavy rains and occasionally high southerly winds prevailed on the Pacific coast during the 23rd. 24th, the centre moved rapidly eastward to north of the Lake region. Light rains continued from the Pacific coast to Utah and Montana, and at many stations thence to the Lake region the maximum temperatures of the month occurred. On the Western Plateau the following temperatures were recorded: —at Winnemucca, 55°, Salt Lake City, 54°, and on the summit of Pikes' Peak, 30°; and the observer at Austin, Nev., described the rain-fall at that place as being very unusual at this season. 25th, the centre passed over New England, with sleet or snow from Maine northward, and warm southwest winds and clear or fair weather southward, but followed at night over the Middle States and New England by brisk to high northwest winds and rapidly falling temperature. Cautionary Off-shore Signals were ordered up on the afternoon of the 25th from North Carolina to Maine, which were all justified. Maximum velocities: Cape Hatteras, N.W. 48; Kittyhawk, N. 50; Cape Henry, N.W. 48; Cape May, N.W. 52; Sandy Hook, N.W. 61; Newport, N.W. 50; Wood's Holl, N.W. 64; Boston, N.W. 50; and Eastport, N.W. 36.

No. XIV—developed on the 25th over the *Western Plateaus*, over which region the high temperatures of the preceding day continued, with cloudy and rainy weather. At 11 p. m. the barometer at Salt Lake City read 29.53, or 0.49 below the normal, having fallen 0.48 in. since the preceding 11 p. m. report. 26th,

lowest pressure moved rapidly over Montana and Dakota to Manitoba, accompanied by light snow or rain and brisk southerly backing to brisk and high northwest winds. Southerly winds and high temperatures prevailed from the Rocky Mountains and the Northwest to the Gulf coast, with clear or fair weather, except in the Southwest, where increasing cloudiness and rain was reported. A heavy thunder-storm occurred at San Antonio from 5 to 6 p. m., and commenced at Corsicana at 7:20 p. m. A tornado is reported to have passed over the town of Lockhart, Texas, at 9 p. m., which destroyed forty houses, killed one child and injured several persons. 27th, was central north of the Lake region and warm southerly winds, cloudy and rainy weather prevailed thence to the Gulf coast and New England; during the latter part of day, clearing or clear weather west of the Mississippi and over the Upper Lakes. 28th, centre passed over Maine and Nova Scotia; southerly to westerly winds and high temperatures continued over the Gulf and Atlantic States, with partly cloudy weather and occasional light rain. In the Lake region and Ohio valley the winds changed to west and north, where the temperature fell about ten degrees. From the 29th to the 31st the pressure continued low and falling over the Canadian Maritime Provinces, with northwesterly winds and occasional light snows. Cautionary Signals were ordered up at Milwaukee, Grand Haven and Ludington on the morning of the 26th; from Cape Hatteras to New York at midnight of the 26th, and along the coast of New England morning of the 27th. These were justified at most stations, the following velocities being recorded: Milwaukee, SE., 30; Grand Haven, —, 32; Alpena, S., 36; Cape May, SW., 30; Wood's Holl, SW., 44.

No. XV—probably developed over the interior of Texas on the 30th, on which day a tornado is reported to have passed northward over a portion of the town of New Braunfels, 30 miles NE. of San Antonio, by which "several buildings were blown to atoms and heavy weights carried great distances;" the storm-cloud moved from the south and was accompanied by hail. Throughout the whole day southerly winds, with temperatures ranging from 63° (a. m. min.) at Mason to 83° (p. m. max.) at Laredo, prevailed south of the 32d parallel, while north of this line northerly winds, with temperatures ranging from 40° (a. m. min.) at Fort Sill to 49° at Fort Griffin. 31st, the depression passed over the Gulf and South Atlantic States, accompanied by cloudy and rainy weather.

## INTERNATIONAL METEOROLOGY.

On chart No. IV. are shown the probable tracks of storm-centres over the oceans, and in the upper right hand corner will be found an index to the same. The following is a brief account of each storm, with a few items selected from the large mass of data made use of. No. I moved northeast off the west coast of Europe on November 23d and 24th and developed into an extensive area of low pressure, which continued over that continent until the 31st. No. II is a continuation of low pressure area No. VIII described in the December REVIEW, which continued its rapid northeast movement over the Atlantic, where low pressures and stormy weather had prevailed for several days previous. It was encountered on the 28th by steamer "Anchoria" in lat. 45° 46' N. long. 49° 43' W., where the pressure had decreased to 28.60; and on the 29th and 30th by steamer "Austrian," which vessel reports the low pressure of 27.88 at 6 a. m. of the 30th in 53° N. 25° W. At Monach Lighthouse, Inverness, the pressure fell during the 29th and 30th and on the morning of the 31st reached 28.50, wind south; at 1 p.m. the wind "flew round like a shot" to north with rising pressure. It is highly probable the storm-area No. (VI and VII,) described in the *December Review*, passed eastward north of New Foundland on December 25th; was encountered on the 27th in 51° N., 31° W. by steamer Mac Gregor, which vessel reported, "wind blew with terrific force, causing tremendous sea, lost four life-boats, 190 head of cattle and 500 sheep;" and finally joined the present storm-area on the 29th to the northwest of the Irish coast. No. III probably formed in the southwest quadrant of area No. II, developed into a severe storm on January 2nd, central about lat. 50° N., lon. 40° W., and after moving north-northeast disappeared on the 5th. No. IV. is a continuation of low pressure area No. II of the present *Review* and which was probably joined on the 9th by a secondary storm-centre (No. V,) from the southward, after which it moved southeast toward France. No. VI is a continuation of area No. IV of the present *Review*, which closely followed in the path of the preceding area, until it arrived at mid-ocean, after which it passed to the north of the British Isles. No. VII probably formed in the southwest quadrant of the preceding area and moved southeastward to France. *Pacific Ocean*.—An area of very low pressure probably existed and moved somewhat in the direction of track traced on Chart from December 19th to the 24th, but sufficient reports are not yet to hand to justify a fuller report.

## TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II illustrate the general distribution of the temperature of the air for the month. By reference to the table on the left side of the chart, it will be seen that the temperature of the month has been very generally about or below the normal except in the Rio Grande valley, the Missouri valley and at the Rocky Mountain stations, where it has been about one and a half degree above.

*Minimum and Maximum Temperatures, respectively:—Maine*—Orono, —21° and 34°; Eastport, —13°, 36°; Portland, 3°, 43°. *New Hampshire*—Mt. Washington, —29°, 26°. *Vermont*—Woodstock, —25°, 51°; Burlington, —12°, 46°. *Massachusetts*—Billerica, —11°, 52°; Boston, 0°, 56°; Springfield, —5°, 52°. *Rhode Island*—Newport, 3°, 44°; Ft. Adams, —4°, 46°. *Connecticut*—Mystic, —16°, 52°; New Haven, 3°, 54°; New London, 0°, 48°. *New York*—Schroon Lake, —33°, 50°; Plattsburg, Bks., —17°, 36°; Buf-